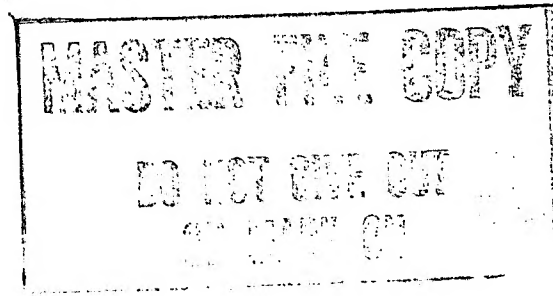




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# **China: Implications of Chemical Industry Development**

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**A Research Paper**

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September 1983*

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# **China: Implications of Chemical Industry Development**

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**A Research Paper**

This paper was prepared by [ ] of the  
Office of East Asian Analysis. Comments and queries  
are welcome and may be directed to the Chief,  
China Division, OEA, [ ]

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**China: Implications  
of Chemical Industry  
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**Summary**

*Information available  
as of 29 July 1983  
was used in this report.*

China has invested heavily in the chemical industry over the past two decades in an effort to reduce dependence on imports, support industrial development, and earn foreign exchange from increased exports. From 1971 to 1980, Beijing poured nearly 12 percent of domestic capital investment and \$5 billion in imported plants and equipment into the chemical industry.

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China's reliance on imported chemicals continues to be substantial, however, with total value of imports dropping in 1981-82 only because of depressed world prices. Although China has expanded production capacity, consumption still exceeds domestic supplies. As a result, we expect China will continue to rely heavily on foreign suppliers for the foreseeable future, particularly for agricultural chemicals, plastics, rubber, and organic chemicals.

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Plans to increase exports have been successful, but such traditional products as resins, medications, and coal tar compounds still dominate Chinese sales abroad. Beijing's expectations for entering international markets as a volume seller of modern chemicals, such as petrochemical products, also have been set back by rising domestic consumption. China has begun to market chemical products more aggressively, but we do not believe it will significantly increase its 1-percent share of world chemical exports. Sales of low-priced Chinese chemicals will provoke such problems as recent antidumping actions by the United States and Europe, but we believe these problems will not be common or predictable.

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Energy availability and efficiency will continue to worry chemical industry officials. During the 1980s, chemicals will be the largest industrial consumer of energy resources, in spite of efficiency drives aimed at closing wasteful chemical factories. Petrochemical production will be a high priority, and, unless new oil resources are found, Beijing will have to divert oil from exports—now about 400,000 barrels per day—to supply petrochemical plants. China plans to increase production of chemicals from coal to complement the oil- and gas-based chemical sector, but these plans will not affect the chemical industry until the late 1980s or early 1990s.

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We expect US firms to benefit from the development of China's chemical industry through both commodity trade and technology transfer. Agricultural chemicals and plastics will continue to dominate US exports to China, with the Chinese market giving a much-needed boost to the depressed US phosphate industry in particular. Beijing also wants US technology and equipment to build or upgrade a variety of chemical plants and to improve the industry's energy efficiency.

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China's exports of chemicals are such a small share of world trade that, even if exports increased substantially, it is unlikely that Chinese chemicals would cost US firms any significant sales in third-country markets. However, we do expect US firms will suffer reductions in exports to China of urea fertilizer by mid-decade. Exports of some plastics also may level off and possibly decline by the late 1980s if China's own capacity potential is realized.

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**Table 1**  
**China: Chemical Industry Growth**

	Chemical Industry		Total Industry		Chemical Share of Total (percent)
	Output Value (billion 1970 yuan)	Growth Rate (percent)	Output Value (billion 1970 yuan)	Growth Rate (percent)	
1977	42.4		372.8		11.4
1978	52.5	23.9	423.1	13.5	12.4
1979	56.2	7.0	459.1	8.5	12.3
1980	62.2	10.8	499.2	8.7	12.5
1981	65.1	4.7	519.9	4.1	12.5
1982	71.3	9.5	559.9	7.7	12.7
1977-82 average annual increase (percent)		11.0		8.5	

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## China: Implications of Chemical Industry Development <sup>1</sup>

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For 20 years Chinese policy for expanding the chemical industry has focused primarily on two problems—meeting the needs of China's huge agricultural sector for fertilizer and agricultural chemicals and developing a domestic petrochemical industry that could provide the array of products used in all industrialized states. The past weakness of the chemical industry had led to a costly dependence upon imports. The discovery of new oil and gas resources in the early 1960s allowed Beijing to embark on a program of constructing large complexes to produce badly needed fertilizers and petrochemical products. At that time, Chinese planners, overestimating the potential impact of new capacity, also began to believe China might develop new export capabilities.

While expanded exports and reduced imports remain the primary motives, the domestic demand created by China's recent economic growth has given further impetus to chemical expansion. Technological advances in industry have created requirements for new or increased supplies of such chemical products as intermediate materials, solvents, lubricants, and plastic or rubber parts. Advances in chemical processing technologies that permit more efficient production also place continuing pressure on the chemical industry to expand and modernize. This paper examines the development of the industry in recent years and assesses the problems Beijing faces in meeting domestic needs and the prospects for a larger Chinese share of the international chemicals market.

### The Chemical Industry's Role in the Economy

The chemical industry is China's third-largest industrial sector after machine building and textiles. Chemical production accounted for about one-eighth

**Table 2**  
**China: Capital Productivity, 1981**

Industry	Gross Output Value per 1,000 Yuan of Fixed Assets (yuan)
<b>Total</b>	<b>957.1</b>
Metallurgy	649.5
Electric power	372.5
Coal and coke	264.9
Petroleum	872.9
Chemical	1,214.8
Machine building	802.9
Building materials	564.8
Forestry	551.1
Food	3,186.4
Textiles	3,245.5

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of gross industrial output value (GVIO) in 1981, nearly double the 1957 share. Massive infusions of foreign technology and equipment in the mid-1960s and again in the 1970s contributed to rapid increases in output value (see table 1).

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Among the 10 major industrial sectors, the chemical industry is second only to textiles as a direct source of economic growth (measured in terms of incremental GVIO). Chemical output yielded about 16 percent of the increase in GVIO between 1977 and 1981. Chemicals also support growth indirectly, providing major inputs to the important agricultural sector and raw materials for other products.

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The chemical industry's capital productivity is high, ranking third behind the textile and food industries (see table 2). Imported technologies contribute greatly to capital intensity in chemical production—imported

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**Table 3**  
**China: Chemical Industry Labor Force <sup>a</sup>**

	Total Industry (million)	Chemical Industry (million)	Share (percent)
1977	29.6	2.8	9.5
1978	29.9	2.8	9.4
1979	30.4	2.8	9.2
1980	32.5	3.0	9.2
1981	34.1	3.1	9.1

<sup>a</sup> Chinese statistics available for state-owned enterprises only.

ammonia plants, for example, produce more than 4,000 tons per worker yearly, about 19 times the output per worker at Chinese-designed plants. Higher capital intensity has also permitted the chemical industry to enlarge its share of production with a declining share of the labor force (see table 3). Labor productivity in state-owned chemical enterprises increased at an average annual rate of 5.8 percent between 1978 and 1981, nearly three times the national average for industry.

#### Investment Trends

Between 1953 and 1981, Beijing directed an average of 10.5 percent of total industrial investment into the chemical industry; modernization drives in 1963-66 and 1973-78 boosted expenditures even higher (see table 4). These efforts were directed at developing modern, large-scale agricultural and organic chemical industries.<sup>2</sup> Beijing invested heavily in fertilizer plants and petrochemical complexes in particular—including imports of whole factories—to reduce dependence on commodity imports and to advance China's ability to produce synthetic fibers, plastics, and rubber. By 1981 agricultural chemicals, organics, plastics, and rubber products were the largest of the chemical

<sup>2</sup> Appendix A provides a more detailed discussion of sectoral development.

**Table 4**  
**China: Investment in the Chemical Industry <sup>a</sup>**

Year	Total Investment in Industry (billion yuan)	Investment in the Chemical Industry (billion yuan)	Chemical's Share of the Total (percent)
1953-57	25.0	1.4	5.6
1958-62	72.8	5.5	7.6
1963-65	21.0	2.4	11.4
1966-70	54.2	6.2	11.4
1971-75	97.8	9.6	9.8
1976	20.9	4.8	23.0
1977	21.7	2.9	13.4
1978	27.3	3.1	11.4
1979	25.7	2.9	11.3
1980	27.4	3.0	10.9
1981	21.5	1.9	8.8
1981-85 (Plan)	120.2	11.4	9.5

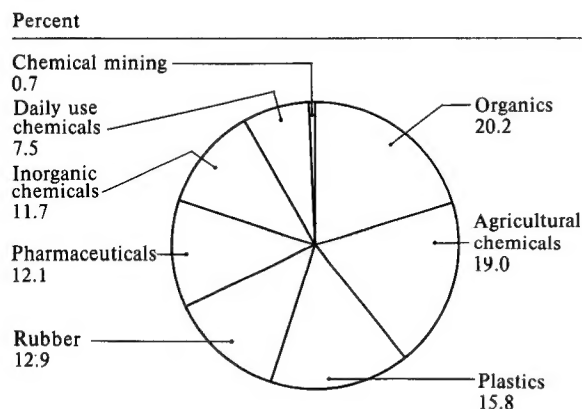
<sup>a</sup> Chinese statistics are available only for state-level capital construction investment. Additional expenditures are made by localities and factories but are not enumerated in published data and, therefore, are not included in these tables.

industry's eight sectors (see figure 1). Now that many of the major processing projects are under way, Beijing is placing greater emphasis upon downstream processes, notably plastic for consumer products. At the same time, investment in the inorganic chemical industry also appears to be increasing (see table 5). Table 6 displays output data for several products, illustrating the impact of China's chemical industry investment.

Investment in chemicals in 1981-85 will drop to 9.5 percent of total industrial investment, according to the Sixth Five-Year Plan. This is because the completion or near-completion of large-scale raw materials processing complexes will allow China to shift investment to downstream chemical plants that are less costly.

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**Figure 1**  
**China: Chemical Production by Sector, 1981**



Total: 65.1 billion Yuan

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### Plant Imports Enhance Expansion

Western plants and equipment have been the underpinnings of China's effort to develop a modern chemical industry. Chemical plants—almost exclusively for petrochemicals and fertilizers—accounted for nearly half the value of plant import contracts signed in 1963-79 (see table 7 and figure 2).

Although China has the capability to build some types of chemical plants, imported facilities are the sole producers of some products and primary producers of many. We estimate, for example, that nearly all of China's ethylene is produced in imported plants or in Chinese-designed plants that use imported equipment; imported urea plants by 1980 produced one-fourth of China's nitrogen fertilizer and 80 percent of its urea.

**Table 5**  
**Allocation of Chemical Investment**  
**1977-81** *Share of total*

Sector	1977	1978	1979	1980	1981
Chemical mining	NA	NA	NA	7.5	4.6
Inorganic and organic	23.0	38.2	44.7	50.5	49.8
Inorganic	NA	NA	NA	9.1	12.9
Organic	NA	NA	NA	41.4	36.9
Agricultural	65.6	47.9	41.9	30.2	23.2
Pharmaceuticals and daily use	4.5	5.5	5.1	8.1	8.3
Rubber and plastic products	NA	NA	NA	3.8	14.1
Of which:					
Plastic products for consumption	NA	NA	NA	0.4	11.2

**Table 6**  
**Chemical Production,**  
**1970-82** *Million metric tons*

Product	1979	1975	1980	1981	1982
Fertilizer <sup>a</sup>	2.44	5.25	12.32	12.39	12.78
Of which:					
Nitrogen	NA	NA	9.99	9.86	10.22
Phosphate	NA	NA	2.31	2.51	2.54
Potassium	NA	NA	0.02	0.02	0.03
Pesticides	0.32	0.42	0.54	0.48	0.46
Sulfuric acid	2.91	4.85	7.64	7.81	8.17
Soda ash	1.08	1.24	1.61	1.65	1.74
Caustic soda	0.89	1.29	1.92	1.92	2.07
Ethylene	0.02	0.07	0.49	0.50	0.56
Plastics	0.18	0.33	0.90	0.92	1.00
Calcium carbide	0.70	0.98	1.52	1.51	1.67
Chemical fibers	0.10	0.15	0.45	0.53	0.52

<sup>a</sup> Fertilizer output shown in nutrient weight.

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**Table 7**  
**China: Chemical Plant Imports**

Year	Value of Chemical Plants (million US \$)	Value of all Plant Contracts (million US \$)	Chemical Plants as a Share of Total (percent)
<b>Total</b>	<b>5,131</b>	<b>11,032</b>	<b>46.5</b>
1963-66	113	210	53.8
1972	0	58	0.0
1973	1,090	1,265	86.2
1974	219	851	25.7
1975	166	408	40.7
1976	91	159	57.2
1977	40	81	49.4
1978	3,325	6,934	48.0
1979	87	1,066	8.2

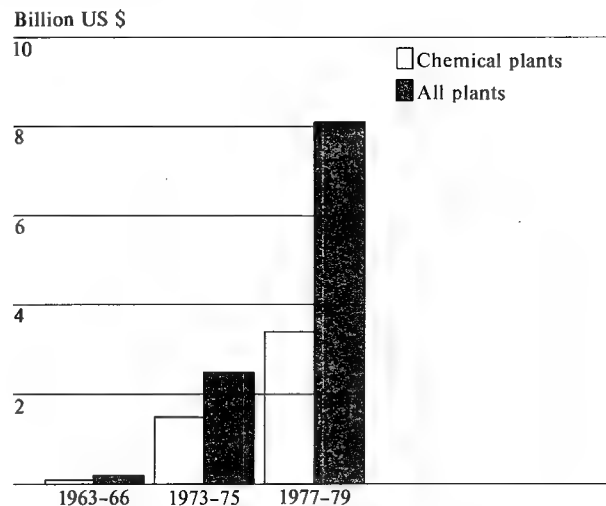
Chinese-designed plants predominantly produce inorganic chemicals and low-grade fertilizers. In general, the technologies are outmoded by Western standards; nevertheless, they are suited to small-scale production for local use. Without imported plants, we estimate that China's capacity to produce ethylene would be less than 5 percent of current levels; plastics, 15 percent; synthetic fibers (excluding cellulosic), 20 percent; and nitrogen fertilizer, 75 percent.

### Infrastructure Problems

#### Energy

The chemical industry is the largest industrial consumer of energy resources, drawing 17 percent of 1981 electricity output in addition to the oil, gas, naphtha, and coal used as feedstocks. Government concern about energy availability has forced the chemical industry to plan expansion more carefully and to restructure operations for increased efficiency. For example, construction of several fertilizer and petrochemical projects purchased in 1978 was delayed largely to assure availability of energy feedstocks, although financing, demand, location, and transportation factors also were reviewed.

**Figure 2**  
**China: Share of Total Plant Imports Held by Chemical Plants**



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Energy conservation promises to be a continuing pursuit. Under the economic readjustment policies of the past few years, officials specifically sought to close small plants, which produce a variety of goods for local consumption, because of inefficient operations. Many chemical plants were included, especially the almost 2,000 local fertilizer producers. Small, ammonia-based nitrogen fertilizer plants are the most intensive and inefficient energy consumers in the chemical industry. We estimate that in 1978 these plants alone used 4.5 percent of China's electricity supply and accounted for 2.6 percent of total energy consumption. By 1981 nearly one-fourth of these 2,000 plants were closed, electricity use was down to 3.7 percent and energy use to 3.1 percent. Nevertheless, in 1981 the nitrogen fertilizer industry as a whole still consumed 4.5 percent of energy supplies to produce less than 2 percent of GVIO.

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During a January 1983 industry meeting, the Chemical Ministry launched a new efficiency drive aimed at closing as many as 400 mainly smaller plants by 1985 if they cannot increase quality and reduce energy consumption. We estimate that planned 1985 output levels for nitrogen fertilizer alone will require 4.3 percent of projected primary energy production. [ ]

#### Petroleum Feedstock Prospects

China's large-scale petrochemical complexes run on crude oil supplied primarily by the Daqing and Shengli oilfields. Shengli's output is declining, putting more of a burden on Daqing where officials also expect output to diminish in the late 1980s. At the same time, demand for feedstocks will increase at least 25 percent when facilities now under construction come on stream. We believe China will reduce Daqing exports—currently around 10 million metric tons yearly—if necessary to maintain supplies, rather than cut back petrochemical production. [ ]

Some planners in Guangdong Province and the Shenzhen Special Economic Zone near Hong Kong also are considering constructing additional facilities in southern China in the late 1980s that may increase requirements by an additional 30 percent or more. [ ]

[ ] Any all-new complexes would depend on offshore oil supplies and probably will not be built if supplies are not assured. [ ]

#### Transportation

Inadequate rail and water transport facilities delay deliveries, which can cause deterioration of some chemical products. Some factories have built costly pipelines to assure steady feedstock supplies. But where raw materials are distant from final consumers—the Qinghai potassium beds in western China relative to eastern agricultural areas, for example—rail transport is crucial and delays delivery up to six months. Sloppy handling in transit adds to the problem; *China Daily* reports that 8 percent of yearly chemical fertilizer output is wasted by bags breaking during shipment. [ ]

**Table 8**  
**China: 1985 Production Plans**

Million metric tons  
(except where noted)

Product	1982 Output	1985 Target	Average Annual Rate of Growth Required (percent)
Fertilizers	12.78	13.40	1.6
Of which:			
Nitrogen	10.22	10.55	1.1
Phosphate	2.54	2.80	3.3
Potassium	0.025	0.05	26.0
Sulfuric acid	8.17	8.10	
Soda ash	1.74	1.90	3.0
Caustic soda	2.07	2.10	0.5
Ethylene	0.56	0.70	7.7
Plastics	1.00	1.05	1.6
Synthetic rubber	0.12	0.17	12.3
Chemical fibers	0.52	0.78	14.5
[ ]			

#### Chemicals in the Sixth Five-Year Plan

The Sixth Five-Year Plan's goals for expanding chemical production are likely to be met easily. Of those products for which specific levels are enumerated, we believe only chemical fertilizers will not meet the target. Sufficient capacity already is under construction to fulfill plan requirements for ethylene, plastics, synthetic rubber, and chemical fibers. Sulfuric acid and caustic soda are already at 1985 levels, and soda ash capacity can be added easily (see table 8). [ ]

#### Chemical Fertilizers

Sufficient nitrogen fertilizer capacity will be added to meet the 1985 target, but slow expansion of other fertilizers means that additional nitrogen production will impede China's efforts to balance its product mix (see appendix A). Phosphate output may approach the 1985 goal only if existing plants are run more efficiently or small plants are added; planned large-scale

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projects will not be completed before 1986. Similarly, the large Qinghai potassium project will not be operational before the end of the plan period, so potassium increases will have to come from smaller projects. We do not expect the additional output from the small plants to contribute enough to reach the plan's objectives. [ ]

### Petrochemicals

Beijing reorganized the petrochemical industry this year to streamline operations and management. The China Petrochemical Corporation falls directly under the State Council and oversees more than 50 refineries and petrochemical complexes, and almost all research, trade, and planning. The corporate form was chosen to remedy the bureaucratic confusion caused by past involvement of the Ministries of Chemicals, Petroleum, and Textiles in the management of chemical facilities. [ ]

### Coal Chemicals

China plans to develop a coal chemical sector to supplement the oil- and gas-fed industry. It plans to develop a major chemical industry in Shanxi Province using abundant local coal. A large nitrophosphate fertilizer plant there will be the first of several coal chemical plants that will include calcium carbide and other carbide products. A second coal chemical facility will be in Shenyang in northeast China, where officials plan to produce benzene, naphthalene, tar, and acids. We believe coal chemicals will not be a significant factor in chemical production until the late 1980s or early 1990s. [ ]

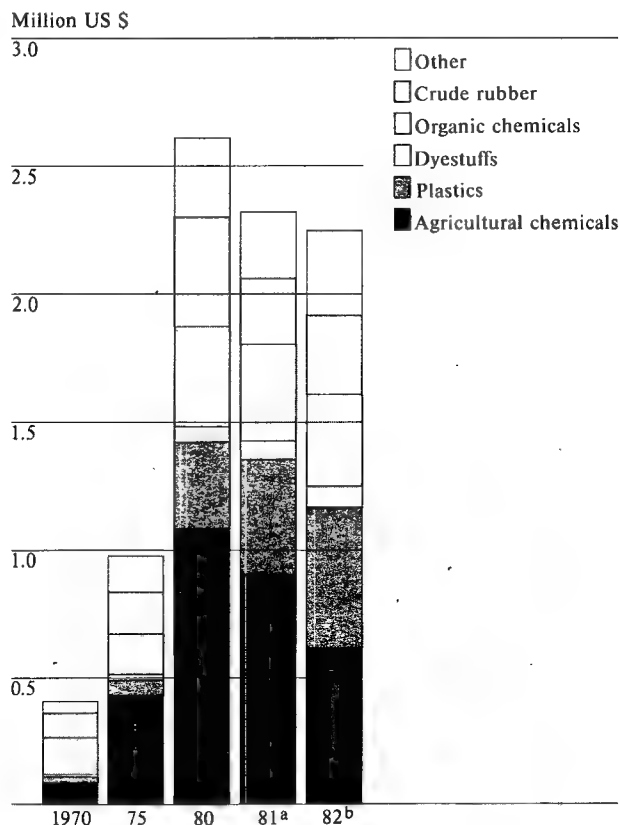
### Chemical Trade

#### Imports Reflect Development Priorities

China buys about 1.6 percent of world exports of chemicals. Agricultural chemicals, plastics, crude rubber (synthetic and natural), and organic chemicals dominate China's chemical imports, with textile dyestuffs a small but growing factor (see figure 3). Chemicals and rubber have accounted for 13 to 14 percent (\$2.2-2.6 billion) of the value of all imports in each of the last three years. [ ]

Agricultural chemicals—mostly nitrogen fertilizers—account for the largest share of chemical imports.

**Figure 3**  
**China: Major Chemical Imports**



<sup>a</sup> Lower import value in 1981-82 reflects depressed world prices, not reduced volume.

<sup>b</sup> Estimate.

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Depressed fertilizer prices in 1982 held down total value, although volume of imports continued to rise. Imports of potassium, phosphate, and compound (multinutrient) fertilizer products are also beginning to increase. Reports from the Spring 1983 Trade Fair in Guangzhou suggest that purchases of pesticides and the intermediate chemicals used to manufacture pesticides are up sharply this year after a decline in 1982.

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Plastics purchases have jumped 150 percent—twenty-fold in value—between 1970 and 1982 and vie with agricultural chemicals as the leading chemical import. Rubber imports fell off in 1981, largely the result of reductions in tire production, but recovered somewhat in 1982. The organic chemical category covers a broad range of products. Some of the more notable imports are ethylene glycol and terephthalic acid (both used in the manufacture of polyester) and phthalic anhydride (used in the manufacture of plastics, polyester, and insecticides). Official Chinese trade data for 1982 also show increased interest in inorganics after a lull in 1981. Purchases of soda ash increased 150 percent and of caustic soda nearly 700 percent (in volume) last year. These two products have a myriad of uses in manufacturing other products and the large volume of 1982 imports cannot be attributed to any particular activity. [ ]

For many products, Beijing's hopes to reduce imports by adding capacity have been frustrated by rapidly expanding consumption. For example, in 1973 China purchased 13 urea fertilizer complexes capable of producing almost 6.8 million metric tons annually, more than enough to cover that year's imports (2.5 million tons) plus expected increases in consumption. By 1980 these plants on the average were operating at 70 percent of capacity, producing about 4.8 million tons—nearly double the 1973 import level. However, small plant closures in 1978-80 cut national capacity by as much as 1.5 million metric tons and consumption levels nearly tripled between 1973 and 1980, so that 1980 import requirements still exceeded 2 million tons. Beijing recognizes that imports will be a long-term necessity and is adding dockside bagging centers to take advantage of lower prices on bulk cargoes. New bagging facilities are already operating in three ports. [ ]

According to recent press reports, the completion of the new Kunming plant will end China's dependence on imports of sodium tripolyphosphate (raw material for synthetic detergent). Imports now cost about \$60 million annually. Import substitution targets may also be met for ethylene glycol. Imports dropped substantially during 1982, probably because of temporarily reduced production of polyester. If polyester output rises in 1983, ethylene glycol imports may also increase. [ ]

**Major Suppliers.** Japan, the United States, West Germany, and Italy are China's largest volume suppliers. Japan has increased exports to China steadily over the last 10 years, but its share of sales has dropped from 70 percent in 1972 to 25 percent in 1982. US sales became significant in the late 1970s, and in 1982 accounted for another 25 percent, exceeding the value of Japanese exports for the first time. [ ]

China seems to acquire some chemical products almost exclusively from certain suppliers. France is virtually the only supplier of activated carbons; the United States, antiknock preparations for fuels. Canada is the major source of potassium fertilizers, the United States of phosphates, and Japan of nitrogen fertilizer and pesticides. [ ]

The Soviet Union and Eastern Europe have increased their share of Chinese imports in recent years. Bloc-produced fertilizers marketed through European firms have kept world prices low and attracted Chinese buyers. The 1983 Sino-Soviet trade agreement pledged shipments of Soviet fertilizer to China but did not specify the volume. [ ]

[ ] we estimate the Soviets may be able to supply up to 0.5 million tons yearly, about one-fourth of China's annual nitrogen fertilizer purchases. Most Sino-Soviet chemical trade to date has been through intermediaries, but Moscow plans a chemical exhibit in Beijing for September 1983, with hopes of expanding direct trade. [ ]

#### Exports: Less Concentrated Than Imports

China is a minor exporter of chemicals, accounting for less than 1 percent of the world market. Exports of chemicals reached \$1.2 billion in 1982 (exclusive of explosives<sup>3</sup>), about 6 percent of China's total sales abroad and equivalent to about half of the cost of

<sup>3</sup> Explosives are included in the Standard International Trade Classification (SITC) chemical category, but the Chinese do not consider them a chemical, and they are not included here. However, exports of explosives—specifically fireworks—have jumped from less than \$5 million in 1970 to more than \$90 million last year, an annual increase of 28 percent. The United States is China's largest customer. [ ]

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chemical imports. Export products are more varied than imports, with the 10 highest valued categories accounting for less than half the total. Exports are dominated by natural products and intermediate chemicals made from natural products. Rosin and resin acids is the top income-producing export, with \$114 million in sales in 1981, or 9.4 percent of chemical exports. Medications, coal tar oils, heterocyclic compounds, and scents and flavors also figure prominently. [REDACTED]

China's customers also are more diverse than its suppliers. In 1982 Hong Kong and Japan were by far the largest buyers, each with only about 15 percent of total exports. The United States accounted for about 11 percent and West Germany, 7 percent. China also exports to other OECD nations, Soviet Bloc countries, a number of lesser developed countries, and newly industrializing countries. [REDACTED]

China plans to expand chemical exports and has begun to market chemical products more aggressively. Some Western manufacturers are concerned that China may be developing specific export capabilities, particularly for petrochemicals, that would undercut the sales of Japanese, North American, and European firms. [REDACTED]

We do not believe China is deliberately developing export capabilities to unsettle world markets, nor do we believe they are capable of doing so in this decade. Expansion, especially of petrochemical capacity, probably will not even meet growing domestic requirements for fibers, plastics, and intermediates for manufacturing. Antidumping actions over sales of menthol, potassium permanganate, and chloropicrin to the United States and barium chloride, oxalic acid, and paracetamol to Europe are likely to recur. However, we believe they will not be common or predictable. With the expansion of chemical capacity under way in the Middle East and other locations, China is not likely to significantly increase its share of world production of most chemicals. [REDACTED]

Quality control problems also restrain China's impact on world chemical markets. Most export products are carefully screened for quality assurance, but China has tried to sell below-par goods. [REDACTED]

#### US Ties to the Chemical Industry

We expect US firms to benefit from the development of China's chemical industry in this decade through both commodity trade and technology transfer. We believe China's consumption of such major commodities as agricultural chemicals, resins, and plastics will outpace increases in production, so import requirements will remain strong. Imports of US chemicals in 1982 amounted to nearly \$500 million, 25 percent of China's chemical imports but only 1.5 percent of US chemical exports. Agricultural chemicals, plastics, and chemical catalysts account for 90 percent of US chemical sales to China. [REDACTED]

The US phosphate industry—depressed since 1980 and facing further downturns because of low domestic demand—will be a major beneficiary of China's imports. At present, the United States supplies perhaps 80 percent of China's imports of phosphate fertilizers. [REDACTED]

We expect China to remain the largest customer for US phosphates. [REDACTED]

#### Technology Transfer Prospects

Expansion of production capacity also will offer opportunities for US involvement. Beijing plans to build at least two phosphate plants based on US technologies [REDACTED]

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[redacted] At least one US firm is also involved in the current construction of three new urea fertilizer plants; although built by Japanese and German companies, the plants use Texaco technology. [redacted]

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China also has explored the feasibility of buying US equipment and technology to produce pesticides, polyvinyl chloride, chlorine, caustic soda, and sulfuric acid. [redacted]

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Several Chinese plants have begun joint ventures with US firms to manufacture chemical products for both domestic and export markets. So far these ventures have focused on daily-use articles and pharmaceuticals, including cosmetics, deodorants, and analgesics. [redacted]

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#### **Potential Losses**

China's exports of chemicals are such a small share of world trade that, even if exports increased substantially, it is unlikely that Chinese products will cause significant competition for US firms in third-country markets. We do expect US exports to China of selected commodities, however, to decline during the 1980s. Chinese imports of US urea fertilizer (sales of which amounted to \$55 million in 1982) may decline with increasing production and the availability of less costly products from Soviet Bloc and Middle Eastern suppliers. Increases in exports of some plastics (polyethylene and polypropylene, with sales of \$213 million in 1982) will probably slow toward mid-decade. If China's own capacity potential is realized, US exports of plastics may level off or even decline in the late 1980s. No other products with a significant share of China's chemical imports are likely to experience major reductions. [redacted]

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## Appendix A

### Sectoral Development

#### Products for Agriculture

The chemical industry provides continuing large-scale support to agriculture. In addition to chemical fertilizers, demand for such products as herbicides, pesticides, and plastic sheet (for mulching) has increased greatly. [redacted]

China is the world's largest buyer of fertilizers, with *nitrogen fertilizer* dominating imports. Industry expansion in the 1960s entailed construction of Chinese-designed, low-grade nitrogen fertilizer plants intended to at least partially supplant import requirements. In spite of increased production, however, imports continued to rise—doubling from 1965 to 1967. Finally, in the early 1970s, policymakers decided to import 13 modern urea (high-grade nitrogen) plants. As those plants became operational, China's reliance on imports [redacted]

[redacted] dropped to 14 percent of supply in 1980 from more than 24 percent in the early 1970s, and it appeared that the import substitution policy was succeeding. Three additional plants are now under construction, but imports are running higher than ever (in volume terms), back up to 16 percent of supply [redacted]

Beijing's long-term preoccupation with nitrogen has left *phosphate and potassium fertilizer* capacity underdeveloped. Without appropriate proportions among these three nutrients, fertilizer applications yield less than optimum results. Chinese media report government anxiety about continuing imbalances. Phosphate, potassium, and compound (multinutrient) fertilizer imports have risen sharply. An Irish firm recently completed a feasibility study for a potassium project in Qinghai Province that eventually may obviate the need for imports. One compound nitrophosphate plant is under construction in Shanxi Province, and a second, imported from Romania, is being built in Anhui. China has large phosphate reserves, but they are inaccessible and, because of impurities, hard to process. Until an effective method is available to exploit domestic resources, officials expect to remain dependent on imports of phosphate rock or

phosphoric acid for inputs to fertilizer plants or on imports of finished phosphate fertilizers. [redacted]

China balances use of *crop-protection chemicals* (insecticides, herbicides, and fungicides) with natural agents. A visiting scientific delegation in 1975 lauded Chinese nonchemical insect controls after observing hundreds of ducks herded through a rice paddy, eating, according to the group's host, about 200 insects per hour per duck. China, however, wants to develop a modern, varied pesticide industry to supplement such biological pest controls. [redacted]

[redacted] DDT and benzene hexachloride (BHC; lindane) were the primary pesticides in use through 1982. However, research on retention of organochlorine pesticide residues in humans led to the issuance in mid-1982 of new health standards and safety regulations for pesticide use, and now Beijing has ordered a halt in production of DDT and BHC by 1985. In spite of highly publicized concern for pesticide safety, the principal alternatives to DDT and BHC are organophosphorous agents, most of which are highly toxic; one safe new product (phoxim) that impressed the 1975 delegation apparently is not yet widely available. [redacted]

The pesticide industry seems to be in disarray. Many factories have been closed or reorganized, first by the readjustment and more recently by the ban on the two major products. Raw materials shortages have reduced operations at some remaining plants. All told, annual production has slipped back to the 1977 level, 15 percent below peak output in 1979-80. Demand has fallen as well. Under the new agricultural incentive program, farmers themselves must buy pesticides that formerly the state distributed, and apparently many believe these pesticides are ineffective and are balking at paying the asking price. In June 1983, Beijing announced plans to build 20 new pesticide

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plants by 1985 with total capacity of 20,000 tons, about a 4-percent addition to current production levels. [ ]

Planned use of *plastic sheets* for mulching will quadruple in 1981-83 but will still cover less than 1 percent of sown area. *Zhongguo Nongmin Bao* reports that yields of cotton and peanuts from mulched fields increased 30 to 70 percent compared with yields from unmulched fields. The Ministry of Agriculture, encouraged by these results, is now urging more widespread use of plastic mulch and has asked the petrochemical corporations to increase production. [ ]

#### Products for the Textile Industry \*

In the early 1970s, Beijing decided to develop a major petrochemical-based *synthetic-fiber* sector, with major new production facilities in Shanghai, Tianjin, Liaoyang, Daqing, Nanjing, and Beijing. By 1979 China had signed nearly \$3 billion in contracts for plants to produce textile-grade synthetic fibers and associated products. The Textile Ministry publicly gave priority to the chemical-fiber sector in 1980, with 80 percent of state investment for the textile industry allocated to chemical fibers. Some of these facilities are under Textile Ministry jurisdiction but are included here since they affect overall chemical industry production. [ ]

China, once reliant on natural fibers, now produces rayon, acetate (cellulosic fibers), nylon, acrylic, and polyester (the noncellulosics). Manmade fibers accounted for 14 percent of fiber production in 1980 and could reach 24 percent by 1985. Their availability has spurred a near revolution in the textile industry, where they have contributed to improved supplies of apparel for both domestic and export markets. [ ]

Synthetic fibers are contributing to other industries as well. Polypropylene is replacing cloth and burlap for shipping bags, for example. Industrial-grade synthetics also serve as tire cord, conveyor belts, tubing, hoses, and other purposes. [ ]

*Dyes and fabric finishes* have not kept pace with textile production capabilities. China has been unable to produce colorfast dyes and other chemical treatments in the quantities and quality needed. It also has been slow to develop and distribute processes for mildew prevention, water and soil repellency, and other such features, concentrating available capacity on export goods instead. Beijing has purchased additional capacity to produce dyestuffs in an effort to upgrade that industry and is slowly expanding other chemical treatment capabilities. [ ]

#### Products for Other Industries

China's *plastics* industry is expanding in conjunction with synthetic fibers since they are, for the most part, coproducts of petrochemical processing. Plastics production originated on a small scale in the 1950s, but received little attention until the 1960s. Imports, mostly of polyvinyl chloride, skyrocketed in 1967 even as new, imported capacity was under construction. In spite of the additions to capacity throughout the 1970s, imports have increased steadily. By 1980, according to the State Statistical Bureau, imports of PVC and polyethylene reached 120,000 tons, nearly 12 percent of supply. [ ]

China's plastics production reached 1 million tons last year, primarily PVC, polystyrene, polypropylene, and high- and low-density polyethylene. The products are manufactured into film and sheet (for packaging, utility, and agricultural use), containers, hose, pipe, cable, and wire insulation; rainwear, shoes, and other consumer goods; and moldings and extrusions such as radio cases. At least one Shanghai plant produces polyvinyl carbazole expressly for electronic components that require high temperature resistance. An imported synthetic leather plant nearly complete in Shandong Province has a design capacity of 3 million square meters, enough to increase the production of leather shoes by 20 percent. [ ]

Beijing plans continued development of the plastics industry. Last year, China acquired polystyrene technology from Japan for a new 5,000-ton plant in Lanzhou to manufacture housings and parts for televisions and other electrical goods, beginning in 1984.

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Currently in demand is Western equipment to upgrade injection molding capabilities and to produce plastic products for consumption such as trash bags, toys, and household containers. [REDACTED]

*Synthetic detergents* have undergone considerable growth with the addition of alkylbenzene plants in Nanjing, Liaoyang, and Beijing and a sodium tripolyphosphate plant in Kunming. *Jingji Guanli* in 1982 revealed that China's per capita detergent output was less than 10 percent of the world average and urged continued expansion. The journal listed synthetic detergents as one product that China will not be exporting for many years. *Toiletries and cosmetics* is one popular sector of the chemical industry that will see expanded exports. China has added capacity for a variety of personal products, including deodorant and plastic razors. Many of these projects are joint ventures with foreign firms with output destined for both domestic use and exports. [REDACTED]

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China also has issued inquiries to increase methyl methacrylate capacity (now less than 12,000 tons) concurrent with acrylonitrile fiber expansion (a by-product of acrylonitrile production is used to manufacture methyl methacrylate). Methyl methacrylate applications cover the full range of uses for clear plastics, from display cases to aircraft windows and protective coatings. [REDACTED]

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China is the world's fifth-largest producer of *natural rubber* (150,000 tons in 1982) and supplements that with *synthetic rubber* (123,000 tons). Domestic production furnishes about half of supply, the balance being natural rubber from Southeast Asia and Sri Lanka and synthetic rubber from the West. The Chinese Academy of Sciences claims discovery of a new catalyst that could double synthetic rubber production, and Agriculture Vice Minister He Kang says China also wants to double production of natural rubber. He Kang expects natural rubber imports to expand, in any case. [REDACTED]

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The two largest consumer products of rubber in China are rubber shoes (including sport shoes) and tires. Rubber footwear output has increased about 3.5 percent annually since 1958 and has become a \$45 million export industry. China and Nike have established a joint venture to produce Nike sport shoes but have had trouble getting the project into production. Tire output dropped sharply in 1981 following the contraction of wheeled vehicle production, but is still the primary rubber product industry. To improve tire quality, China has put an imported nylon tire cord plant into production and wants Western help to manufacture radials. Dunlop (UK) is providing the equipment and know-how to manufacture 130,000 truck tires, half for export, and is discussing additional projects to produce tires, hydraulic hoses, and latex foam. [REDACTED]

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## Appendix C

## Chemical Imports and Exports

Table C-1

Thousand US \$

China: Imports of Chemical Commodities, f.o.b.

SITC Description	1970	1975	1977	1978	1979	1980	1981
231 Rubber, crude (including synthetic and reclaimed):							
2311 Natural rubber and similar natural gums	88,008	155,089	196,347	201,095	294,267	400,785	213,014
2312 Synthetic rubber and rubber substitutes	6,536	9,069	10,963	13,932	17,620	25,871	39,029
2313 Reclaimed rubber	0	2	0	0	0	0	8
2314 Waste and scrap of unhardened rubber	1,339	0	45	55	675	441	91
512 Organic chemicals:							
5121 Hydrocarbons and their derivatives	10,215	19,228	31,077	16,081	14,565	28,517	45,368
51211 Styrene	0	0	85	171	38	840	2,000
51212 Other hydrocarbons	5,031	16,320	24,458	8,520	8,472	18,479	35,259
51213 Halogenated derivatives of hydrocarbons	3,218	1,202	2,890	3,262	2,754	1,682	7,148
51214 Other derivatives of hydrocarbons	1,967	1,706	3,644	4,128	3,301	7,516	961
5122 Alcohols, phenols, phenol-alcohols, glycerine	12,540	36,665	68,309	88,054	90,043	159,360	49,849
51221 Methanol	1,744	1,558	5,570	7,156	4,052	1,103	925
51222 Other acyclic alcohols and derivatives	6,285	23,635	38,019	41,475	45,132	128,262	31,352
51223 Cyclic alcohols and derivatives	9	1	18	39	1	282	113
51224 Ethyl alcohol or neutral spirits	0	0	0	0	0	5	4
51225 Fatty alcohols	0	10	98	882	174	611	414
51226 Glycerol and glycerol lyes	109	263	2,225	6,223	4,145	7,326	2,332
51227 Phenols and phenol-alcohols	4,160	6,519	16,424	23,761	25,668	12,622	11,697
51228 Derivatives of phenols and phenol-alcohols	233	4,680	5,955	8,519	10,871	9,149	3,012
5123 Ethers, epoxides, acetals	292	2,442	2,427	2,984	963	1,517	2,759
51231 Ethers, ether-alcohols, ether-phenols	74	1,039	460	1,164	262	1,424	2,757
51232 Epoxides, epoxyalcohols	218	1,403	1,967	1,820	701	93	2
5124 Aldehyde-, ketone-, and quinone-function compounds	2,390	2,253	5,196	6,999	8,717	4,829	24,672
51241 Aldehydes, aldehyde-alcohols	102	239	360	891	2,325	3,374	4,392
51242 Derivatives of oxygen-function aldehydes	20	338	4	48	246	140	460
51243 Ketones, ketone-alcohols	2,268	1,675	4,833	6,060	6,146	1,315	19,820
5125 Acids and their derivatives	3,499	37,084	47,608	47,075	42,166	77,570	153,097
51251 Monoacids and their anhydrides	1,597	5,148	7,455	8,821	11,758	11,910	17,980
51252 Polyacids and their anhydrides	776	28,710	38,291	36,490	28,356	63,392	131,921
51253 Oxygen-function acids and derivatives	1,126	3,226	1,862	1,764	2,053	2,268	3,196
5126 Inorganic esters, their salts and derivatives	5,436	9,673	11,836	15,321	12,023	5,594	312
51261 Sulphuric esters and their salts	0	22	0	0	0	0	0
51262 Nitrous and nitric esters	0	1	0	0	0	0	0

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Table C-1

Thousand US \$

## China: Imports of Chemical Commodities, f.o.b. (continued)

SITC Description	1970	1975	1977	1978	1979	1980	1981
51263 Phosphoric esters and their salts	56	51	27	4,569	6,636	3,978	217
51264 Carbonic esters and their salts	0	0	28	0	0	0	0
51269 Other esters of mineral acids	5,380	9,600	11,781	10,752	5,387	1,616	95
5127 Nitrogen-function compounds	105,704	16,354	28,236	43,345	45,958	52,106	56,444
51271 Amine-function compounds	2,681	2,898	9,722	15,718	23,209	32,344	18,185
51272 Single or complex oxygen-function aminocompounds	3,156	6,215	6,145	9,632	8,089	9,219	25,405
51273 Quaternary ammonium salts and hydroxides	54	5	26	1	53	28	35
51274 Amide-function compounds	96,764	5,783	10,650	14,600	10,136	8,271	7,468
51275 Imide-function compounds	254	121	301	1,006	1,582	217	22
51276 Nitrile-function compounds	2,590	1,173	4	1	220	1,367	1,010
51277 Diazo-, azo-, and azoxy-compounds	152	150	260	221	648	511	78
51278 Organic derivatives of hydrazine or hydroxylamine	0	2	6	33	0	11	8
51279 Compounds with other nitrogen functions	52	6	1,123	2,133	2,021	137	4,232
5128 Organo-inorganic and heterocyclic compounds	6,213	35,308	31,398	41,740	39,437	60,171	42,973
51281 Organo-sulphur compounds	163	1,753	1,060	1,494	722	216	1,315
51282 Organo-arsenic compounds	0	30	48	0	0	0	0
51283 Organo-mercury compounds	354	0	12	0	27	24	18
51284 Other organo-inorganic compounds	3	265	165	649	977	4,583	1,675
51285 Heterocyclic compounds	5,333	33,074	30,045	39,338	37,654	55,320	39,914
51286 Sulphonamides	360	174	64	260	55	24	52
51287 Sultones and sultams	0	13	3	0	2	4	0
5129 Other organic chemicals	382	43	84	231	1,173	1,730	2,267
51291 Enzymes	0	8	14	67	80	106	497
51292 Sugar, chemically pure, excluding sucrose, glucose, lactose	0	0	5	94	3	2	2
51299 Other organic compounds	382	35	64	70	1,090	1,622	1,767
513 Inorganic chemicals: elements, oxides and halogen salts:							
5131 Oxygen, nitrogen, hydrogen, rare gases	0	134	4	34	133	109	59
51311 Oxygen	0	2	0	0	0	0	0
51312 Nitrogen	0	19	0	0	0	0	0
51313 Hydrogen and rare gases	0	112	4	0	0	0	0
5132 Chemical elements NES	1,036	2,983	12,992	28,537	26,591	6,374	1,546
51322 Other halogens	333	63	37	669	587	208	132
51323 Sulphur, sublimed or precipitated, colloidal sulphur	0	8	2,467	1,519	1,414	2,390	771
51324 Metalloids NES	5	0	2,681	7,896	7,981	289	445
51325 Mercury	0	0	102	0	0	0	0

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Table C-1 (continued)

Thousand US \$

SITC Description	1970	1975	1977	1978	1979	1980	1981
51326 Alkali, alkaline-earth, and other rare earth metals	3	0	0	1	32	7	4
51327 Carbon black, and so forth	696	2,903	7,704	18,452	16,576	3,480	194
51328 Gas carbon	0	9	0	0	0	0	0
5133 Inorganic acids and oxygen compounds of nonmetals	47	100	146	478	462	751	396
51331 Hydrochloric acid and chlorosulphonic acid	0	3	0	1	0	15	35
51333 Sulphuric acid, oleum	0	5	0	7	1	20	50
51334 Nitric acid, sulphonitric acids	0	32	14	0	0	8	12
51335 Phosphorus pentoxide and phosphoric acids	0	0	0	56	19	50	16
51337 Boric oxide and boric acid	0	0	1	223	174	241	2
51339 Other inorganic acids and compounds of nonmetals, metalloids	47	60	130	191	268	417	281
5134 Halogen and sulphur compounds of nonmetals or metalloids	1,192	543	88	105	76	29	138
51341 Halides, and other compounds of nonmetals or metalloids	457	34	0	1	19	29	138
51342 Sulphides of nonmetals or of metalloids	735	509	88	104	57	0	0
5135 Metallic oxides, of a kind used in paints	176	3,439	5,158	5,708	6,366	8,201	9,472
51351 Zinc oxide and zinc peroxide	0	0	326	56	784	8	33
51352 Manganese oxides	0	752	1,706	1,194	934	143	331
51353 Iron oxides and hydroxides	4	1	0	0	16	2	53
51354 Cobalt oxides and hydroxides	0	0	1	38	2	41	13
51355 Titanium oxides	170	2,217	1,387	1,567	1,611	4,048	6,934
51356 Lead oxides	3	469	1,738	2,853	3,019	3,958	2,107
5136 Other inorganic bases and metallic oxides	728	4,080	7,961	11,064	30,521	45,676	19,236
51361 Ammonia, anhydrous or in aqueous solution	0	0	0	0	32	2,305	2
51362 Sodium hydroxide	3	594	5,668	9,238	26,376	36,621	18,192
51363 Other hydroxides, peroxides of sodium or potassium	0	30	0	7	0	449	136
51364 Oxides of strontium, barium, or magnesium	0	5	0	217	250	428	8
51365 Aluminium oxide and hydroxide	0	1,503	127	321	232	109	69
51366 Artificial corundum	0	443	348	9	42	4	110
51367 Chromium oxides and hydroxides	558	0	1,049	656	2,264	5,585	191
51368 Tin oxides (stannous oxide and stannic oxide)	0	121	0	0	0	0	0
51369 Other inorganic bases and metallic oxide, hydroxide, peroxide	166	1,384	769	615	1,326	176	528
514 Other inorganic chemicals:							
5141 Metallic salts and peroxysalts of inorganic salts	14,380	54,363	20,053	24,276	29,946	29,155	26,915
51411 Fluorides, fluorosilicates, fluoroborates	0	1	22	147	1	13	45
51412 Chlorides and oxychlorides	13,634	52,704	19,782	23,895	29,846	29,085	26,335

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**Table C-1**  
**China: Imports of Chemical Commodities, f.o.b. (continued)**

Thousand US \$

SITC Description	1970	1975	1977	1978	1979	1980	1981
51413 Chlorites and hypochlorites	3	0	0	0	0	2	0
51414 Chlorates and perchlorates	0	140	61	234	99	55	535
51415 Bromides, oxybromides, bromates, perbromates, hypobromites	3	0	0	0	0	0	0
51416 Iodides, oxyiodides, iodates, and periodates	739	1,518	188	0	0	0	0
5142 Other metallic salts and peroxysalts of inorganic acids	3,625	11,249	15,165	25,017	26,756	31,299	16,173
51421 Sulphides, including polysulphides	57	0	2	10	3	18	315
51422 Dithionites, including stabilized with organic substances	96	123	1,063	2,564	827	0	53
51423 Sulphites and thiosulphates	35	6	7	0	0	19	86
51424 Sulphates (including alums) and persulphates	2,107	2,342	3,193	4,949	9,609	5,821	1,210
51425 Nitrites and nitrates	2	2	10	212	708	854	603
51426 Phosphites, hypophosphites, and phosphates	1,226	8,540	10,871	15,539	13,193	9,583	12,832
51427 Arsenites and arsenates	4	0	0	0	0	0	0
51428 Neutral sodium carbonate (soda ash)	0	218	17	1,740	2,256	14,782	818
51429 Other carbonates and percarbonates	98	18	1	2	159	222	256
5143 Other metallic salts and peroxysalts of inorganic acids	3,790	5,035	5,765	6,000	12,978	14,894	10,118
51431 Cyanides and complex cyanides	3,048	1,860	1,135	1,854	1,874	155	414
51432 Fulminates and cyanates	31	0	290	0	1	1	2
51433 Silicates	0	4	1	2	89	137	47
51434 Borates and perborates	0	47	67	6	50	46	7
51435 Salts of metallic acids	3	1,064	2,505	2,428	5,674	9,663	9,298
51436 Other salts and peroxysalts of inorganic acids	0	7	1,402	1,423	5,259	3,949	222
51437 Colloidal precious metals and compounds, organic or inorganic	708	2,053	364	286	30	943	129
5149 Inorganic chemical products NES	2,259	6,589	7,501	13,120	16,307	14,013	10,626
51492 Hydrogen peroxide	0	108	146	85	10	10	46
51494 Calcium carbide	2,251	6,406	7,049	12,373	15,650	13,790	10,399
51495 Other carbides	2	60	242	444	517	193	19
51496 Hydrides, nitrides and azides, silicides, and borides	1	0	61	2	16	7	17
51499 Other inorganic compounds, NES	5	16	3	216	114	13	145
515 Radioactive and associated materials:							
5151 Radioactive chemical elements and isotopes	54	187	517	73	311	427	369
5152 Stable isotopes and their compounds	0	17	0	3	3	32	46
5153 Compounds, inorganic or organic of thorium	0	0	0	0	1	13	0

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Table C-1 (continued)

Thousand US \$

SITC Description	1970	1975	1977	1978	1979	1980	1981
521 Mineral tar and crude chemicals from coal, oil, and natural gas:							
5211 Mineral tar	0	15	0	0	0	0	0
5214 Oils and other products of distilled coal tar	1,150	1,207	8,455	11,388	10,956	95	274
531 Synthetic organic dyestuffs, natural indigo, color lakes:							
5310 Synthetic organic dyestuffs, natural indigo, color lakes	10,382	20,677	32,587	52,642	74,718	60,930	71,761
53101 Synthetic organic dyestuffs and natural indigo	10,382	20,629	31,675	52,533	74,565	60,614	71,713
53102 Color lakes	0	48	912	109	153	316	48
532 Dyeing and tanning extracts, synthetic dyeing materials:							
5321 Dyeing extracts (vegetable and animal)	27	10	62	5	85	50	195
5323 Synthetic tanning materials	6	10	8	33	298	544	790
5324 Tanning extracts of vegetable origin	1,075	16	626	459	653	1,905	684
533 Pigments, paints, varnishes, and related materials:							
5331 Coloring materials, NES	313	3,426	5,026	3,592	4,866	7,917	10,478
5332 Printing ink	1	259	265	257	528	649	1,247
5333 Prepared paints, enamels, lacquers, varnishes, mastics	1,835	4,860	7,133	12,549	6,737	7,848	23,408
53331 Prepared pigments	1,231	185	1,572	494	1,456	2,034	1,732
53332 Varnishes and lacquers	475	3,929	5,495	11,969	5,191	5,408	21,193
53333 Artists colors	0	163	9	11	8	58	44
53334 Prepared driers	130	0	0	0	1	17	182
53335 Putty, painters' fillings, and so forth	0	582	57	75	81	331	256
541 Medicinal, pharmaceutical products:							
5411 Provitamins and vitamins	216	459	371	472	135	259	543
5413 Antibiotics, penicillin, streptomycin	56	41	266	240	56	2,360	2,024
5414 Vegetable alkaloids, their salts and derivatives	661	2,740	1,989	894	2,628	1,535	123
5415 Hormones	52	426	176	302	171	436	4,505
5416 Glycosides, glands and their extracts; sera, and vaccines	116	225	238	181	745	1,016	3,028
54161 Glycosides, natural or reproduced by synthesis	24	14	5	6	7	43	86
54162 Organo-therapeutic glands or other organs, not powdered	84	14	116	40	709	924	2,722

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Table C-1.

Thousand US \$

## China: Imports of Chemical Commodities, f.o.b. (continued)

SITC Description	1970	1975	1977	1978	1979	1980	1981
54163 Bacterial products, sera, vaccines	8	197	116	136	28	49	219
5417 Medicaments	1,376	3,838	3,210	5,158	7,709	12,262	16,513
5419 Pharmaceutical goods	443	1,299	1,204	1,698	1,461	1,316	1,088
54191 Wadding, gauze, bandages, and similar articles	443	0	11	0	150	382	484
54199 Other pharmaceutical goods	0	1,299	1,193	1,698	1,311	934	604
551 Essential oils, perfume and flavor materials:							
5511 Essential oils	41	449	738	716	1,189	1,364	1,837
5512 Synthetic perfume and flavor materials and concentrates	6	146	129	99	213	729	2,522
55121 Terpenic byproducts of essential oils	0	22	67	0	0	0	0
55123 Mixtures of odoriferous substances	6	124	62	99	213	729	2,522
553 Perfumery, cosmetics, and toilet preps. (except soap):							
5530 Perfumes, cosmetics, and toilet preparations	15	95	170	51	137	940	1,212
554 Soap, cleansing and polishing preparations:							
5541 Soaps	632	974	718	184	184	45	187
5542 Surface-acting agents and washing preparations	1,562	5,582	6,464	9,008	8,104	5,652	9,948
5543 Polishes and creams	4	11	5	3	89	215	426
5611 Nitrogenous fertilizer and fertilizer material	58,534	369,007	293,649	364,201	511,022	673,932	499,142
5612 Phosphatic fertilizers and materials	4,982	13,051	16,798	26,214	34,833	68,515	68,498
56121 Basic slag	0	0	0	0	0	3,206	0
56129 Phosphatic fertilizer and fertilizer material	4,982	13,051	16,798	26,214	34,833	65,309	68,498
5613 Potassic fertilizer and fertilizer material	635	4,499	3,058	8,710	36,299	52,820	90,296
5619 Fertilizers, NES	615	7,298	28,906	75,003	26,524	182,873	143,792
571 Explosives, pyrotechnic products:							
5711 Propellant powders and other prepared explosives	0	24	124	0	134	235	254
57112 Other prepared explosives	0	24	124	0	134	235	254
5712 Fuses, primers, and detonators	3	2	54	0	29	27	63
57121 Mining, blasting, and safety fuses	1	0	5	0	0	0	0
57122 Percussion and detonating caps	2	2	49	0	0	0	0
5713 Pyrotechnic articles	0	1	3	0	173	117	361
5714 Hunting and sporting ammunition	8	1	0	39	50	81	88

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Table C-1. (continued)

Thousand US \$

SITC Description	1970	1975	1977	1978	1979	1980	1981
581 Plastic materials, regenerated cellulose, and artificial resins:							
5811 Condensation, polycondensation products	6,193	12,067	25,337	30,877	56,666	107,072	107,000
5812 Polymerization and copolymerization products	21,053	51,774	66,463	78,270	990,075	231,247	337,022
5813 Regenerated cellulose and vulcanized fibers	708	5,584	6,625	26,344	8,615	33,142	22,207
58131 Vulcanized fiber	1	1	0	0	0	0	0
58132 Regenerated cellulose and chemical derivatives	707	5,583	6,625	26,344	8,615	33,142	22,207
5819 Other artificial resins and plastic materials	1	87	199	248	757	1,074	656
58191 Hardened proteins	0	0	0	0	18	29	0
58192 Modified natural resins, ester gums, and so forth	0	0	0	128	314	7	22
58199 Other artificial plastic materials	1	87	199	120	425	1,038	634
599 Chemical materials and products, NES:							
5992 Disinfectants, insecticides, fungicides	16,244	32,987	32,021	62,391	96,459	102,946	92,587
5995 Starches, insulin, gluten; albuminoidal substances; glues	70	534	485	692	1,061	3,621	8,177
59951 Starches, insulin	0	0	0	0	0	74	76
59952 Gluten and gluten flour	0	0	0	0	0	5	53
59953 Casein, caseinates, derivatives, and casein glues	0	287	186	326	152	612	2,084
59954 Albumins, albuminates, and derivatives	55	144	50	0	0	90	426
59955 Gelatin and gelatin derivatives, and so forth	0	8	57	108	108	63	15
59956 Peptones and other protein substances and derivatives	0	0	58	26	46	111	51
59957 Dextrins, soluble, or roasted starches and starch glues	0	0	0	0	7	21	131
59959 Prepared glues, NES	15	95	133	231	748	2,646	5,340
5996 Wood and resin-based chemical products	0	17	1	1	7	46	87
59962 Concentrated sulphite lye	0	0	0	0	0	5	11
59963 Spirits of turpentine, and so forth	0	0	1	0	0	3	20
59964 Rosin and resin acids, and so forth	0	17	0	0	7	38	56
59965 Wood tar, wood tar oils, and so forth	0	0	0	1	0	0	0
5997 Organic chemical products, NES	4,319	2,591	3,633	9,975	18,620	17,773	14,249
59971 Artificial waxes and prep waxes not emulsified or containing solvents	3	12	42	53	180	159	247
59972 Artificial and colloidal graphite	0	31	76	49	42	13	9
59973 Animal black, including ivory black, bone black	0	18	0	0	0	0	0

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**Table C-1.**  
**China: Imports of Chemical Commodities, f.o.b. (continued)**

Thousand US \$

SITC Description	1970	1975	1977	1978	1979	1980	1981
59974 Prepared glazings and mordants	49	144	914	1,456	2,557	1,377	970
59975 Antiknock preparations, and so forth	3,834	2,176	1,836	4,982	12,352	14,028	12,782
59976 Prepared rubber accelerators	433	166	716	3,291	3,322	1,997	12
59977 Prepared culture media	0	11	49	144	113	157	171
59978 Charges for fire extinguishers	0	33	0	0	56	42	57
5999 Chemical products and preparations, NES	2,798	17,804	22,616	25,570	38,005	57,175	36,947
59991 Modeling pastes and dental impression compounds	0	0	0	1	0	3	24
59992 Activated carbon and activated natural mineral products	4	22	573	79	3,066	5,979	1,736
59994 Pickling preparations for metal surfaces, fluxes, and so forth	0	15	14	213	54	233	216
59995 Composite varnish solvents and thinners	0	13	2	16	83	262	402
59999 Other chemical products and preparations, NES	2,794	17,753	22,026	25,260	34,802	50,698	34,569

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Table C-2

Thousand US \$

## China: Exports of Chemical Commodities, f.o.b.

SITC Description	1970	1975	1977	1978	1979	1980	1981
231 Rubber, crude (including synthetic and reclaimed):							
2311 Natural rubber and similar natural gums	99	33	73	641	1,260	1,495	2,351
2312 Synthetic rubber and rubber substitutes	4	23	7	152	1,006	3,111	1,949
2313 Reclaimed rubber	3	24	46	61	125	352	412
2314 Waste and scrap of unhardened rubber	0	0	0	0	0	0	5
512 Organic chemicals:							
5121 Hydrocarbons and their derivatives	79	1,832	1,481	2,613	17,065	21,511	22,815
51211 Styrene	0	0	0	2	1	48	0
51212 Other hydrocarbons	16	74	168	1,463	14,861	14,684	14,532
51213 Halogenated derivatives of hydrocarbons	18	459	418	257	1,023	2,970	4,626
51214 Other derivatives of hydrocarbons	45	1,299	895	892	1,180	3,809	3,657
5122 Alcohols, phenols, phenol-alcohols, and glycerine	2,547	9,395	12,577	22,744	39,874	61,785	61,102
51221 Methanol	49	140	168	208	1,965	8,917	5,999
51222 Other acyclic alcohols and derivatives	13	1,135	1,349	1,584	10,692	15,427	11,981
51223 Cyclic alcohols and derivatives	2,087	7,538	10,365	19,550	24,847	26,869	30,125
51224 Ethyl alcohol or neutral spirits	111	108	247	122	102	117	793
51225 Fatty alcohols	0	0	3	8	66	7	9
51226 Glycerol and glycerol lyes	1	3	10	19	0	20	246
51227 Phenols and phenol-alcohols	277	376	398	1,217	2,004	9,590	11,370
51228 Derivatives of phenols and phenol-alcohols	9	94	36	36	199	837	579
5123 Ethers, epoxides, and acetals	323	548	923	781	1,482	4,152	4,902
51231 Ethers, ether-alcohols, and ether-phenols	283	521	888	778	1,479	3,958	4,729
51232 Epoxides, epoxyalcohols	0	0	0	0	0	191	167
51233 Acetals and hemiacetals	40	27	35	3	3	3	6
5124 Aldehyde-, ketone-, and quinone-function compounds	2,897	6,569	6,067	9,273	10,863	20,131	18,672
51241 Aldehydes and aldehyde alcohols	1,328	3,080	2,476	3,270	4,092	4,777	5,805
51242 Derivatives of oxygen-function aldehydes	1	21	40	92	137	244	216
51243 Ketones and ketone alcohols	1,568	3,468	3,551	5,911	6,634	15,110	12,651
5125 Acids and their derivatives	2,120	4,643	8,753	11,714	24,279	52,639	49,562
51251 Monoacids and their anhydrides	702	2,000	3,293	5,113	11,488	21,824	20,027
51252 Polyacids and their anhydrides	1,225	1,362	2,582	2,896	7,290	19,390	15,680
51253 Oxygen-function acids and derivatives	194	1,280	2,878	3,705	5,501	11,425	13,855
5126 Inorganic esters, their salts and derivatives	12	50	94	37	131	674	869
51261 Sulphuric esters and their salts	0	0	1	8	0	0	0
51263 Phosphoric esters and their salts	0	17	5	19	16	302	429
51264 Carbonic esters and their salts	0	4	0	0	0	0	0
51269 Other esters of mineral acids	0	29	88	10	115	372	440
5127 Nitrogen-function compounds	1,244	7,753	6,115	9,187	18,373	37,959	40,780

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Table C-2

Thousand US \$

## China: Exports of Chemical Commodities, f.o.b. (continued)

SITC Description	1970	1975	1977	1978	1979	1980	1981
51271 Amine-function compounds	6	120	294	456	686	2,355	4,895
51272 Single or complex oxygen-function amino compounds	730	3,664	1,297	5,164	6,736	17,281	16,754
51273 Quaternary ammonium salts and hydroxides	296	516	895	693	890	1,176	1,107
51274 Amide-function compounds	33	898	1,158	1,642	4,389	7,795	8,929
51275 Imide-function compounds	142	1,414	1,566	925	2,549	5,763	5,482
51276 Nitrile-function compounds	36	683	486	42	2,734	2,532	1,141
51277 Diazo-, azo-, and azoxy-compounds	1	444	355	221	372	956	2,429
51278 Organic derivatives of hydrazine or hydroxylamine	0	2	1	16	2	3	3
51279 Compounds with other nitrogen-functions	0	11	63	29	15	98	41
5128 Organo-inorganic and heterocyclic compounds	2,461	24,596	18,269	27,842	51,091	73,687	96,242
51281 Organo-sulphur compounds	65	640	1,257	1,598	3,258	7,345	14,987
51283 Organo-mercury compounds	3	8	14	24	57	136	48
51284 Other organo-inorganic compounds	0	29	123	364	421	671	682
51285 Heterocyclic compounds	2,205	21,259	10,618	16,089	26,948	41,773	54,143
51286 Sulphonamides	187	2,660	6,255	9,749	20,284	23,495	26,090
51287 Sultones and sultams	0	0	1	18	124	267	293
5129 Other organic chemicals	499	316	847	841	1,791	2,151	3,086
51291 Enzymes	2	100	232	204	431	1,018	1,997
51292 Sugar, chemically pure, excluding sucrose, glucose, and lactose	0	76	39	54	118	151	237
51299 Other organic compounds	497	141	576	583	1,242	982	852
513 Inorganic chemicals: elements, oxides, and halogen salts:							
5131 Oxygen, nitrogen, hydrogen, rare gases	3	19	2	4	10	39	515
51313 Hydrogen and rare gases	3	19	0	0	10	39	515
5132 Chemical elements, NES	288	1,226	1,223	2,288	10,559	25,799	45,364
51321 Chlorine	0	1	17	19	52	278	34
51322 Other halogens	12	0	0	0	569	616	7
51323 Sulphur, sublimed or precipitated, and colloidal sulphur	37	74	147	145	266	244	1,456
51324 Metalloids NES	20	95	102	41	684	9,126	31,452
51325 Mercury	219	1,039	832	1,927	8,277	12,985	8,434
51326 Alkali, alkaline-earth, and other rare earth metals	0	0	34	2	0	114	471
51327 Carbon black, and so forth	0	18	91	154	710	2,436	3,509
5133 Inorganic acids and oxygen compounds of nonmetals	659	3,004	2,307	2,110	3,101	5,133	9,449
51331 Hydrochloric acid and chlorosulphonic acid	18	20	5	16	48	301	433
51332 Sulphur dioxide	0	0	0	12	0	0	0

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Table C-2 (continued)

SITC Description	1970	1975	1977	1978	1979	1980	1981
51333 Sulphuric acid; oleum	4	64	49	106	130	281	544
51334 Nitric acid; sulphonitric acids	3	22	2	3	31	56	171
51335 Phosphorus pentoxide and phosphoric acids	31	1,287	1,086	1,070	1,328	1,963	3,471
51336 Arsenic trioxide, pentoxide, and acids of arsenic	303	953	321	27	60	105	87
51337 Boric oxide and boric acid	258	234	277	134	438	951	2,189
51339 Other inorganic acids and compounds of nonmetals, metalloids	42	424	567	742	1,067	1,475	2,554
5134 Halogen and sulphur compounds of nonmetals or metalloids	3	85	11	6	47	86	50
51341 Halides, and other compounds of nonmetals or metalloids	0	46	0	0	23	62	28
51342 Sulphides of nonmetals or of metalloids	3	39	11	6	24	24	22
53335 Putty, painters' fillings, and so forth	116	347	469	444	617	659	1,017
541 Medicinal, pharmaceutical products:							
5411 Provitamins and vitamins	192	1,484	1,935	2,733	4,134	18,168	16,489
5413 Antibiotics, penicillin, and streptomycin	343	3,760	5,535	7,444	17,139	41,674	41,251
5414 Vegetable alkaloids, their salts and derivatives	10	6,772	3,202	2,979	5,019	11,607	10,073
5415 Hormones	12	485	291	408	1,796	5,761	5,459
5416 Glycosides, glands and their extracts; sera, and vaccines	271	1,956	2,312	4,956	8,514	10,555	12,292
54161 Glycosides, natural or reproduced by synthesis	19	282	197	227	668	891	920
54162 Organo-therapeutic glands or other organs, not powdered	232	1,581	2,115	3,904	6,242	7,575	9,122
54163 Bacterial products, sera, and vaccines	21	93	0	825	1,603	2,089	2,250
5417 Medicaments	8,688	35,539	42,234	49,696	63,000	77,935	81,899
5419 Pharmaceutical goods	2,307	8,797	9,868	11,521	13,451	17,946	22,243
54191 Wadding, gauze, bandages, and similar articles	2,256	8,506	9,792	10,990	12,834	17,640	21,446
54199 Other pharmaceutical goods	51	291	76	531	617	306	797
551 Essential oils, perfume, and flavor materials:							
5511 Essential oils	14,227	21,599	33,572	33,162	47,065	56,484	46,941
5512 Synthetic perfume and flavor materials and concentrates	455	1,031	780	719	1,312	1,856	2,180
55121 Terpenic byproducts of essential oils	176	73	82	0	11	30	18
55122 Concentrates of essential oils	0	2	1	0	27	28	28
55123 Mixtures of odoriferous substances	275	956	697	713	1,241	1,771	2,114
55124 Aqueous distillates and solutions of essential oils	4	0	0	6	33	27	21

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**Table C-2**  
**China: Exports of Chemical Commodities, f.o.b. (continued)**

Thousand US \$

SITC Description	1970	1975	1977	1978	1979	1980	1981
553 Perfumery, cosmetics, and toilet preparations (except soap):							
5530 Perfumes, cosmetics, and toilet preparations	2,284	6,822	9,053	11,459	9,811	13,207	15,025
554 Soap, cleansing and polishing preparations:							
5541 Soaps	1,781	12,367	13,653	15,803	12,118	15,116	15,871
5542 Surface-acting agents and washing preparations	917	4,683	4,406	5,287	6,820	11,034	10,726
5543 Polishes and creams	221	415	519	388	593	659	843
561 Fertilizers, manufactured:							
5611 Nitrogenous fertilizer and fertilizer material	2	135	52	852	1,259	1,906	3,156
5612 Phosphatic fertilizers and materials	25	28	0	0	66	28	439
56129 Phosphatic fertilizer and fertilizer material	25	28	0	0	66	28	439
5613 Potassic fertilizer and fertilizer material	0	53	338	687	1,058	1,578	1,656
5619 Fertilizers, NES	2	0	25	2	23	0	131
571 Explosives, pyrotechnic products:							
5711 Propellant powders and other prepared explosives	35	473	10	4	301	599	1,549
57112 Other prepared explosives	35	473	10	4	301	0	1,549
5712 Fuses, primers, and detonators	2	15	0	7	5	122	137
57121 Mining, blasting, and safety fuses	0	0	0	3	0	12	14
57122 Percussion and detonating caps	0	15	0	4	0	110	123
5713 Pyrotechnic articles	4,768	21,890	42,516	49,184	71,731	93,571	91,739
5714 Hunting and sporting ammunition	1	18	8	17	6	59	18
581 Plastic materials, regenerated cellulose, and artificial resins:							
5811 Condensation, polycondensation products	127	1,037	999	2,211	3,800	4,477	5,783
5812 Polymerisation and copolymerisation products	795	1,536	2,648	4,366	35,128	53,896	39,116
5813 Regenerated cellulose, vulcanized fibers	102	253	275	837	1,915	3,330	3,780
58131 Vulcanised fiber	0	4	0	0	0	0	8
58132 Regenerated cellulose and chemical derivatives	102	249	275	837	1,915	3,330	3,772
5819 Other artificial resins and plastic materials	108	896	3,143	4,207	6,959	11,070	12,456
58191 Hardened proteins	0	0	0	44	0	20	22
58192 Modified natural resins, ester gums, and so forth	24	324	794	1,825	2,331	136	227
58199 Other artificial plastic materials	84	572	2,349	2,338	4,628	10,914	12,207

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Table C-2 (continued)

Thousand US \$

SITC Description	1970	1975	1977	1978	1979	1980	1981
599 Chemical materials and products, NES:							
5992 Disinfectants, insecticides, and fungicides	2,713	4,014	7,122	9,441	9,448	14,100	18,126
5995 Starches, insulin, gluten; albuminoidal substances; glues	3,915	9,697	7,368	11,246	11,451	18,080	14,860
59951 Starches and insulin	918	4,049	2,322	678	1,995	4,545	3,668
59952 Gluten and gluten flour	0	3	46	7	3	10	7
59953 Casein, caseinates, derivatives, and casein glues	1	15	35	47	33	20	12
59954 Albumins, albuminates, and derivatives	1,364	814	195	937	785	619	495
59955 Gelatin and gelatin derivatives, and so forth	1,422	4,256	4,054	8,953	7,529	11,065	9,285
59956 Peptones and other protein substances and derivatives	22	3	43	140	186	940	396
59957 Dextrins, soluble or roasted starches and starch glues	7	3	92	4	3	26	47
59959 Prepared glues, NES	181	552	581	480	917	855	949
5996 Wood and resin-based chemical products	37,003	62,408	63,275	56,106	86,319	104,789	120,549
59961 Tall oil	42	270	117	50	334	309	579
59962 Concentrated sulphite lye	0	7	57	157	153	46	27
59963 Spirits of turpentine, and so forth	4,745	3,301	3,119	3,828	6,838	6,818	6,220
59964 Rosin and resin acids, and so forth	32,163	58,720	59,957	52,006	78,832	97,497	113,617
59965 Wood tar, wood tar oils, and so forth	54	98	25	66	163	120	105
59966 Vegetable pitch and so forth	0	11	0	0	0	0	0
5997 Organic chemical products NES	269	1,376	709	805	1,855	3,497	6,906
59971 Artificial waxes and prepared waxes not emulsified or containing solvents	8	43	107	293	1,096	548	216
59972 Artificial and colloidal graphite	214	57	56	157	113	1,944	5,680
59973 Animal black, including ivory black and bone black	0	3	8	6	7	85	28
59974 Prepared glazings and mordants	39	31	2	3	96	27	28
59975 Antiknock preparations, and so forth	1	1,058	367	265	293	461	483
59976 Prepared rubber accelerators	5	175	169	79	249	422	454
59977 Prepared culture media	0	0	0	0	0	7	3
59978 Charges for fire extinguishers	2	9	0	1	2	4	14
5999 Chemical products and preparations, NES	1,813	3,569	8,415	5,785	14,477	24,727	28,415
59991 Modeling pastes and dental impression compounds	15	30	51	69	104	70	96
59992 Activated carbon and activated natural mineral products	103	121	312	496	1,214	3,444	3,495
59993 Ferrocium and other pyrophoric alloys	372	762	883	938	1,170	1,543	1,084
59994 Pickling preparations for metal surfaces, fluxes, and so forth	1	5	16	0	1	56	40
59995 Composite varnish solvents and thinners	14	29	70	43	30	18	80
59999 Other chemical products and preparations, NES	1,309	2,621	7,084	4,239	11,958	19,596	23,619

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